

Radio Talk by Linus Pauling May 1949

Los Angeles, California

I like to talk about atoms, and to think about them. We know a great deal about atoms and molecules now, and the physical scientists who have investigated this part of our world have done a good job. As I look at this crystal of uranyl nitrate hexahydrate that I hold in my hand I do not see the atoms that I know constitute the substance - to see them I need a complex instrument, which even includes some calculating machines. But I know that each uranium atom is 6.11 \AA from other uranium atoms, with 1 \AA equal to $1/254,000,000$ of an inch, and I know how the uranium atom is surrounded by other atoms, of oxygen, nitrogen, hydrogen. To obtain this knowledge the physical scientists have used very powerful instruments, capable of far greater magnification than the 200-inch telescope on Mt. Palomar; for the atoms in this crystal have the same apparent size, to my eye, as oranges on the surface of the moon - and no astronomer as yet has hopes of seeing oranges on the moon. And the nuclei, in the centers of the atoms, are still smaller, ten thousand times smaller: the nuclei in this crystal have the same apparent size as minute grains of dust, one-thousandth of an inch in diameter, on the surface of the moon. It is these tiny particles - our knowledge of and control over these tiny particles - that have made the world of today crucially different from the world of

ten years ago.

A few pounds of uranium 235 or plutonium 239 and machinery for detonating it constitute an old-fashioned atomic bomb, of the Hiroshima-Nagasaki type. The reaction of these nuclei liberates in a millionth of a second as much energy as is liberated by the detonation of twenty million pounds of TNT. We know that at Hiroshima one of these old-fashioned bombs killed 80,000 people. A member of Congress has stated that 1949-model bombs are six times as powerful as the earlier bombs. And now we, and presumably the Russians too, are working on hydrogen bombs. A hydrogen bomb consists of an old-fashioned atomic bomb surrounded by a ton, or perhaps ten tons or more, of hydrogen or other light elements, the nuclei of which can fuse together to form heavier nuclei, with the liberation of around five times as much energy, on a weight basis, as in a fission bomb. There may be present a hundred or a thousand or ten thousand times as much explosive material as in the old-fashioned atomic bomb (which serves simply as a detonator for the hydrogen bomb, by raising the temperature to several million degrees), and most scientists predict that hydrogen bombs a thousand times more powerful than an old-fashioned atomic bomb can be designed and constructed in a few months or years. There seems to be no theoretical limit on the size of these terrible weapons.